23660 EXPEDITED HANDLING BOX AF

IN THE U.S. PATENT AND TRADEMARK OFFICE

Inventor	Willem J. QUADAKKERS	
Patent App.	10/586,089	
Filed	13 July 2006	Conf. No. 1161
For	PROTECTIVE LAYER FOR AN ALUMINUM-CONTAINING ALLOY FOR HIGH	
Art Unit	1793	Examiner Fogarty, C

Hon. Commissioner of Patents
Mail Stop AF
Box 1450
Alexandria, VA 22313-1450

THIRD AMENDMENT - AFTER FINAL ACTION

This is in response to the Office Action mailed 02 March 2009.

The rejection is based on a misinterpretation of the main reference, US 6,599,636 of Alger and a misunderstanding of the instant invention, in part possibly caused by misstatements in the Remarks section of the previous amendment.

More particularly Alger recites in column 3, starting at line 9 (emphasis added):

> In one embodiment of the present invention, the reactive barrier coating is formed on the surface of the titanium aluminide substrate in a low-oxygen environment. The substrate is heated to an elevated temperature,

> preferably between about 870 and about 1050°C., in an environment of hydrogen, with a partial pressure of water vapor, preferably about 1 to about 750 ppm, and more preferably between about 1 to about 500 ppm. The temperature is between about 550 and about 1100°C. At this temperature and pressure, all non-specific reactive elements on the surface are reduced. As the less stable surface oxides are reduced by hydrogen, aluminum and titanium atoms are exposed to the fresh oxygen produced by the dissociation of the water vapor and from the dissociation of less stable surface metal oxides which have formed on the substrate. These aluminum and titanium atoms react with the oxygen to produce strong stable aluminum and titanium oxides. These specific reactive element oxides are too stable to be reduced by the hydrogen/water vapor atmosphere.

This is not a disclosure that Ti is deposited on the aluminum alloy. No Ti is deposited, instead it is an essential component of the substrate alloy.

Instead in Alger the Al-Ti alloy is heated in an oxygen-poor atmosphere. This reduces all nonspecific reactive elements on the surface. The freed oxygen reacts with the Al and Ti atoms of the surface to form stable Al and Ti oxides (column 2, lines 46 - 64). The thus formed Ti_2O_3 and α-Al_2O_3 oxides, which are mutually soluble, form as a result of the equilibrium constant α-Al_2O_3 directly at the interface with the Al-Ti alloy while a layer of Ti_2O_3 forms on the outer surface (column 4, lines 20 to 52). Subsequently when these two layers are exposed at normal pressure

to an oxygen-containing atmosphere such as air a TiO_2 layer forms on the surface.

This way of forming the protective layer in Alger is only possible with an Al-Ti alloy as substrate and requires to start with an expensive oxygen-poor atmosphere, in fact with a very low hydrogen partial pressure (column 2, lines 46-53).

This is in contrast to the method of the instant invention for forming such a protective layer on any aluminum alloy. Ti is not required in the substrate alloy, since the metal that allows formation of the protective layer is an additionally deposited layer of Fe, Ni, Cr, or Ti. Only after formation of this intermediate layer is the layered substrate heated above 800°C. There is no way a Ti-Al laminate can be equated with a Ti-Al alloy.

In other words, in Alger the Ti must be provided in the substrate alloy. Using this starting material, Alger then employs a costly oxygen-poor, low-pressure, and high-temperature treatment. This is completely different from using a base alloy of FeCrAl or NiAl to form with high-temperature exposure an Al oxide scale. With low pressure, the Al-oxide is metastable instead of the stable α-Al oxide, so such low-temperature oxidation is not desired. The application of a thin metal layer of Ni, Fe, Cr, or Ti according to the invention, which is nowhere suggested in Alger, since a laminate is altogether different from an alloy, on a base of FeCrAl

or NiAl prevents the formation of metastable Al-oxide and creates only a stable α-Al oxide.

The instant invention as defined in claims 1-10 is clearly different from the cited art. Nothing in Alger suggests the inventive step of "depositing Ni, Fe, Cr, or Ti on the surface of the alloy in an oxygen atmosphere to form on the alloy an oxide layer having non-aluminum-containing oxides." The claims are clearly allowable over the cited art.

If only minor problems that could be corrected by means of a telephone conference stand in the way of allowance of this case, the examiner is invited to call the undersigned to make the necessary corrections.

K.F. Ross P.C.

/Andrew Wilford/

by: Andrew Wilford, 26,597
Attorney for Applicant

18 May 2009
5683 Riverdale Avenue Box 900
Bronx, NY 10471-0900
Cust. No.: 535
Tel: 718 884-6600
Fax: 718 601-1099
Email: *email@kfrpc.com*